RADAR BREADBOARD FOR DSP SCATTEROMETER

Dorothy K. Stosic
Jet Propulsion Laboratory, California Institute of Technology
Pasadena, CA. 91109
Phone: 818-354-1657
Fax: 818-393-6875
dkstosic@jpl.nasa.gov

James P. Lux
Jet Propulsion Laboratory, California Institute of Technology
Pasadena, CA. 91109
Phone: 818-354-2075
Fax: 818-393-6875
jimlux@jpl.nasa.gov

The design and testing results for the Radio Frequency (RF) portion of a breadboard polarimetric scatterometer operating at 13.402 GHz are presented. An integrated breadboard has been developed at Jet Propulsion Laboratory (JPL) to evaluate a programmable Digital Signal Processing (DSP) approach for a follow-on scatterometer similar to SeaWinds (scheduled for launch in winter 2002).

Breadboard development of an integrated system has been identified as being a valuable asset in determining effective subsystem requirements for the eventual flight instrument. From such a breadboard, potential compatibility and partitioning issues between the RF and DSP hardware are actively addressed early on with empirical results to back-up feasibility of the new polarimetric technology. It also gives the scientists an opportunity to evaluate Commercial Off-The-Shelf (COTS) parts, while developing the breadboard at a fraction of the cost.

Benefits for utilizing polarimetry over conventional methods result in the same quantity of information that is processed in half the number of "looks". With half the amount of data to process but with the same amount of information, decreases the amount of error introduced. Less error means more accurate results. Since polarimetry has never been used on any previous orbiting scatterometer, where data has already proven invaluable, it is likely to make what was once known as good data in the past, unacceptable in the future.

Disadvantages of a polarimetric design include additional requirements to an already long list. With two receivers now operating in place of just one in the currently orbiting design means gain and phase accuracy between the receivers now needs to be addressed. Overall, this makes the design more difficult to implement.

The RF portion of the breadboard described consists of a dual channel receiver, converting the received signal at 13.402 GHz to the IF of 37 MHz for the analog to digital conversion, and a single channel transmitter, that converts the I/Q baseband transmit waveform up to Ku band. Both the transmitter and receiver utilizing this new technology have been built and tested in breadboard form, and preliminary results have demonstrated the system to be a viable option. While many issues, such as power restraints, radiation effects and thermal problems still need to be addressed, this new version of scatterometer looks promising.

Lastly, the breadboard makes provision for emulating capabilities such as programmable attenuators, loop-back calibration, and saturation effects in an actual instrument's power amplifier. Since, the RF hardware in conjunction with the DSP comprise a somewhat simplified version of a scatterometer, these technologies can be implemented within the polarimetric design to better mimic an actual flight instrument. (In flight, the actual system requires a level of redundancy, which, in case of failure, would allow the system to remain usable). In this breadboard model, the RF hardware has been tested and the system fail-safes are currently being evaluated; Initial results look promising. Consequently, it is believed that the breadboard can be used to work out most of the integration issues, which usually remain unsolved until the very end- causing schedule delay and many long work weeks.

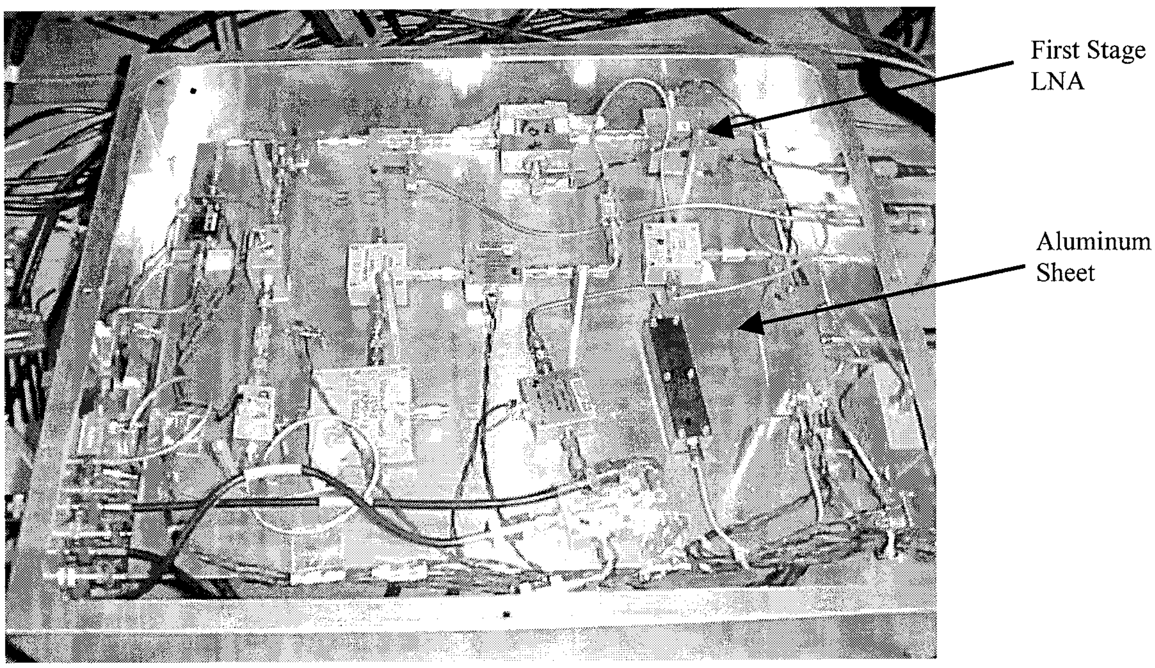

Figure 1: Photograph of inside the receiver box. One receiver is shown, with second hidden under aluminum sheet.

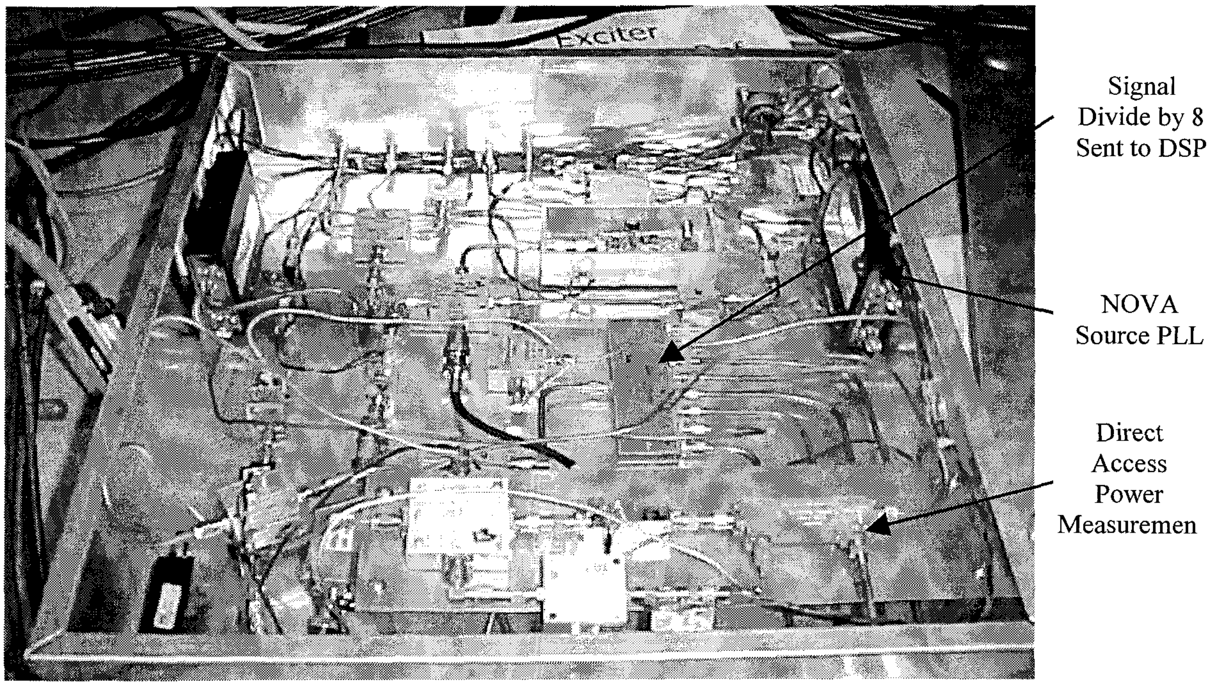

Figure 2: Photograph of transmitter box.

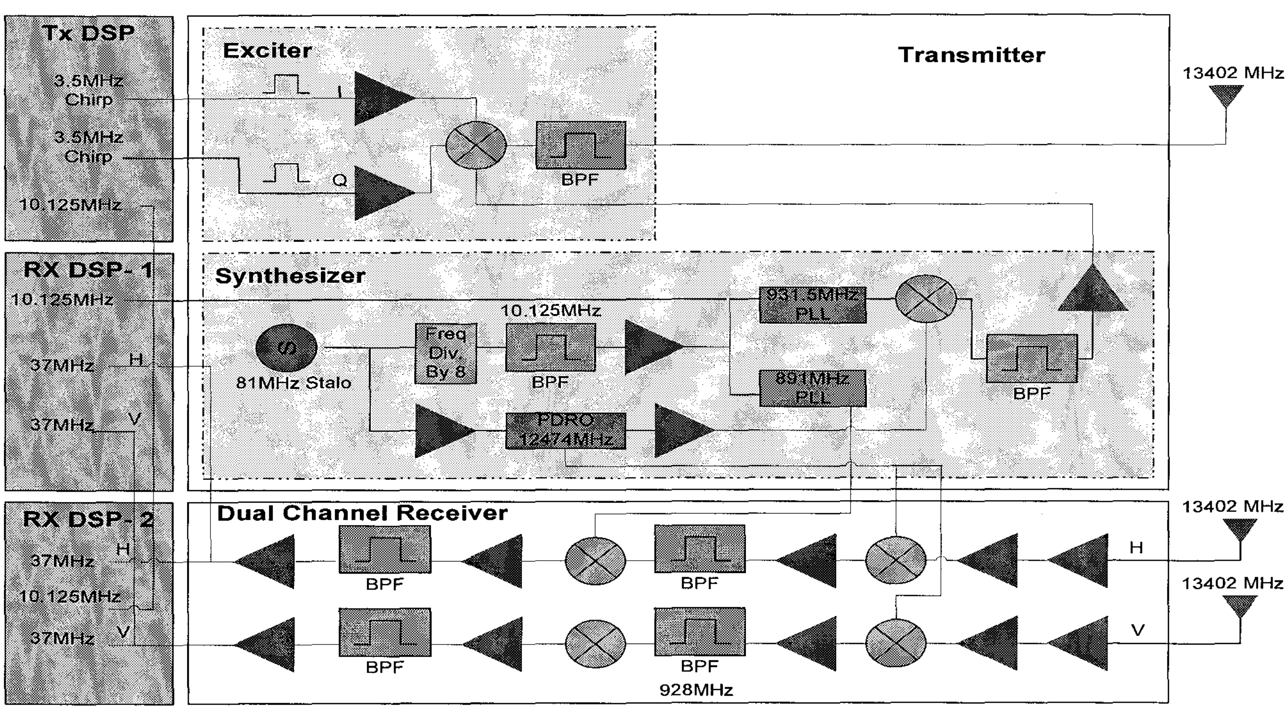

Figure 3: Radar Block Diagram with DSP's.